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SOLAR/1015-79/06

Monthly Performance Report

FEB 14 1980
U.S. DEPOSITORY

PERL-MACK ENTERPRISES, INC.

JUNE 1979

U.S. Department of Energy

National Solar Heating and Cooling Demonstration Program

National Solar Data Program

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MONTHLY PERFORMANCE REPORT
PERL-MACK ENTERPRISES, INC.
JUNE 1979

I. SYSTEM DESCRIPTION

The Perl-Mack Enterprises, Inc. site is a single family dwelling, 2,229 square feet of living area, in Denver, Colorado. The solar energy system is designed to provide approximately 68 percent of the annual space heating and hot water energy requirements for the home. It has an array of flat-plate collectors, manufactured by Miromit, with a gross area of 470 square feet that faces south at an angle of 30 degrees from the horizontal. A water-glycol solution is used as the medium for delivering solar energy from the collector array to storage located in the basement. The energy is stored in a 853-gallon tank after the transfer fluid passes through a liquid-to-liquid heat exchanger. Preheating of incoming city water is accomplished in a 40-gallon tank immersed within the 853-gallon tank. A gas burner in a conventional, 40-gallon hot water tank furnishes auxiliary energy for water heating. When solar energy is insufficient, a forced air, natural gas furnace provides additional energy for space heating.

The system, shown schematically in Figure 1, has five modes of solar operation.

Mode 1 - Collector-to-Storage: This mode is entered when the collector outlet temperature exceeds the water thermal storage temperature by 10°F (adjustable). The transfer fluid is circulated through the collectors, through the heat exchanger HX2, and back to the collectors until the temperature differential drops to less than 2°F.

Mode 2 - Storage-to-Space Heating: This mode prevails when the room temperature drops to the setting of the thermostat, and the temperature in the water thermal storage is 90°F or higher. Energy from storage is transferred to liquid-to-air heat exchanger HX1 located in the air-handling unit.

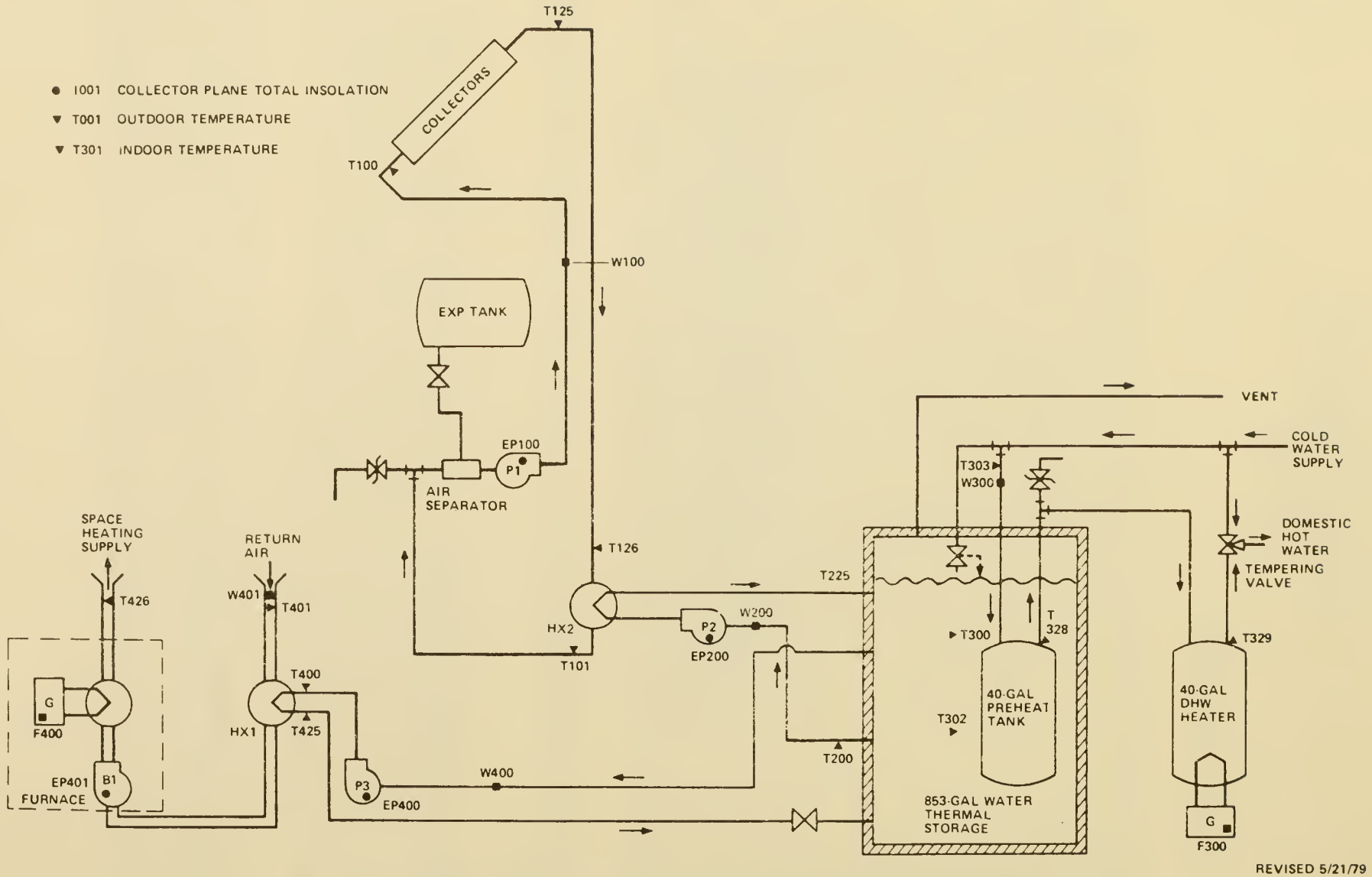

Figure 1. PERL–MACK ENTERPRISES SOLAR ENERGY SYSTEM SCHEMATIC

Mode 3 - Domestic Water Preheat: This mode exists when there is a demand for hot water. Incoming city water flows through the preheat tank immersed in the water thermal storage and then to the conventional hot water heater (DHW heater).

Mode 4 - Excess Heat Rejection: This mode occurs when the water thermal storage temperature exceeds 170°F and Mode 1 has been terminated. Pumps P1 and P2, in this mode, extract energy from storage and transfer it to the collectors for exchange to the outside ambient air. In addition, vapor in the water thermal storage is vented to the outside of the house.

Mode 5 - Snow Removal from Collector: This mode is accomplished by a manual override switch which permits the homeowner to turn on the collector pump P1 and storage pump P2 to transfer energy from water thermal storage to the collectors. The purpose of this mode is to remove snow from the collectors before normal insolation and collection would be expected to begin. This mode terminates automatically after a preset time interval of approximately 15 minutes.

II. PERFORMANCE EVALUATION

The system performance evaluations discussed in this section are based primarily on the analysis of the data presented in the attached computer-generated monthly report. This attached report consists of daily site thermal and energy values for each subsystem, plus environmental data. The performance factors discussed in this report are based upon the definitions contained in NBSIR 76-1137, Thermal Data Requirements and Performance Evaluation Procedures for the National Solar Heating and Cooling Demonstration Program.

A. Introduction

The solar energy system at the Perl-Mack Enterprises, Inc. site operated continuously during the month of June with domestic hot water as the predominate energy load.

For each month of this heating season, the instrumentation, which measures the natural gas usage, has become progressively less reliable when a comparison is made between the measured gas usage and the gas billing for the month as received by the homeowner. For the month of June, the billing receipts have been used as a baseline, and the measured natural gas usage for heating and domestic hot water have been modified accordingly.

With these adjustments to the data, the solar contribution was 75 percent of the combined heating and domestic hot water load of 1.71 million Btu, and was produced at the expense of 0.33 million Btu to operate electrical pumps in the solar energy collection and storage subsystem (ECSS).

B. Weather

The average outside ambient temperature for June was 67°F as compared with the long-term average of 66°F. The measured insolation in the collector plane averaged 1,930 Btu/ft^2-day. The long-term average insolation for June is 2,138 Btu/ft^2-day derived from measurements taken at the Denver airport. The insolation and ambient temperature were abnormally low from 7 June through 9 June.

C. System Thermal Performance

Collector - Of the 27.2 million Btu of energy incident on the collector array, 18.96 million Btu were incident on the array when pumps P1 and P2 (Figure 1) were operating. The system collected 8.38 million Btu, or 31 percent of the total insolation incident on the collector array. The operation of pumps P1 and P2 consumed 0.33 million Btu of electrical energy during collection.

Storage - Of the 8.38 million Btu of solar energy collected, 6.95 million Btu were delivered to the water thermal storage. Delivery loss between the collector and storage was 1.44 million Btu. A total of 1.70 million Btu was removed from storage for use by the loads, and the net change in energy within the water thermal storage for the month was a net loss of

0.19 million Btu. Storage losses of 5.05 million Btu resulted in a storage efficiency of 27 percent. Relatively high insolation for most of the month resulted in an average storage temperature of 143°F, ranging from a low average temperature of 100°F to a high of 156°F.

Domestic Hot Water Load - An average of 75 gallons of hot water was used each day of occupancy, and was delivered at an average temperature of 139°F. The consumed hot water was replaced with cold water at an average temperature of 62°F, which resulted in a measured total hot water load of 1.51 million Btu. The total hot water load is independently measured, as well as the solar energy used, and the auxiliary thermal energy used. The difference between the sum of the solar and auxiliary contributions and the total load is assigned to plumbing energy losses and averaged 0.50 million Btu for the month. The solar fraction was 73 percent.

Space Heating Load - The space heating solar energy usage of 0.18 million Btu represented 92 percent of the total space heating load of 0.20 million Btu. The auxiliary fossil fuel of 0.23 million Btu provided 0.02 million Btu of auxiliary thermal energy based on an assumed furnace efficiency of 64 percent.

D. Observations

The solar system operation was normal. Auxiliary energy was used for space heating during a cold snap on 7 through 9 June and then discontinued for the remainder of the month. There was limited collection for three days because of adverse weather conditions. Energy was rejected from the collector array in Mode 4 on 21 June for a period of three hours, during which time the storage tanks temperature was reduced from 168°F to 156°F. Losses of 6.99 million Btu to the conditioned space continue to be typical of past performance.

E. Energy Savings

The Perl-Mack solar energy system resulted in estimated savings of 2.72 million Btu of natural gas during June, at the expense of -0.33 million Btu of electricity for operating the solar energy portion of the system. The

savings are based solely on the use of controlled solar energy, as measured, and do not include losses. The savings of 2.72 million Btu are the natural gas equivalent of the 1.65 million Btu of solar energy assumed to have been removed from storage and supplied to the conditioned space and to the domestic hot water heater.

III. ACTION STATUS

None.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: FERL-MACK ENTERPRISES SOLAR/1015-79/06
REPORT PERIOD: JUNE,1979

SITE/SYSTEM DESCRIPTION: THE SOLAR ENERGY SYSTEM PROVIDES DOMESTIC HOT WATER AND SPACE HEATING FOR A SINGLE FAMILY RESIDENCE. FLAT PLATE COLLECTORS USE GLYCOL-WATER FLUID. A HEAT EXCHANGER TRANSFERS ENERGY TO A WATER STORAGE TANK WHICH PREHEATS WATER TO THE GAS FIRED DOMESTIC HOT WATER HEATER. SPACE HEATING IS PROVIDED BY AN AIR TO WATER HEAT EXCHANGER IN THE GAS FIRED FURNACE PLENUM.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	27.203	MILLION BTU
	57908	BTU/SQ.FT.
COLLECTED SOLAR ENERGY	8.382	MILLION BTU
	17842	BTU/SQ.FT.
AVERAGE AMBIENT TEMPERATURE	67	DEGREES F
AVERAGE BUILDING TEMPERATURE	80	DEGREES F
ECSS SOLAR CONVERSION EFFICIENCY	0.06	
ECSS OPERATING ENERGY	0.329	MILLION BTU
TOTAL SYSTEM OPERATING ENERGY	0.352	MILLION BTU
TOTAL ENERGY CONSUMED	9.660	MILLION BTU

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL	
LOAD	1.509	0.199	N.A.	1.708	MILLION BTU
SOLAR FRACTION	73	92	N.A.	75	PERCENT
SOLAR ENERGY USED	1.462	0.184	N.A.	1.646	MILLION BTU
OPERATING ENERGY	N.A.	0.023	N.A.	0.352	MILLION BTU
AUX. THERMAL ENERGY	0.542	0.015	N.A.	0.557	MILLION BTU
AUX. ELECTRIC FUEL	N.A.	N.A.	N.A.	N.A.	MILLION BTU
AUX. FOSSIL FUEL	0.903	0.023	N.A.	0.927	MILLION BTU
ELECTRICAL SAVINGS	N.A.	-0.003	N.A.	-0.332	MILLION BTU
FOSSIL SAVINGS	2.436	0.288	N.A.	2.724	MILLION BTU

SYSTEM PERFORMANCE FACTOR: 0.814

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: PERL-MACK ENTERPRISES SOLAR/1015-79/06
REPORT PERIOD: JUNE,1979

SITE/SYSTEM DESCRIPTION: THE SOLAR ENERGY SYSTEM PROVIDES DOMESTIC HOT WATER AND SPACE HEATING FOR A SINGLE FAMILY RESIDENCE. FLAT PLATE COLLECTORS USE GLYCOL-WATER FLUID. A HEAT EXCHANGER TRANSFERS ENERGY TO A WATER STORAGE TANK WHICH PREHEATS WATER TO THE GAS FIRED DOMESTIC HOT WATER HEATER. SPACE HEATING IS PROVIDED BY AN AIR TO WATER HEAT EXCHANGER IN THE GAS FIRED FURNACE PLENUM.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	28.699 GIGA JOULES
	657598 KJ/SQ.M.
COLLECTED SOLAR ENERGY	8.842 GIGA JOULES
	202611 KJ/SQ.M.
AVERAGE AMBIENT TEMPERATURE	19 DEGREES C
AVERAGE BUILDING TEMPERATURE	27 DEGREES C
ECSS SOLAR CONVERSION EFFICIENCY	0.06
ECSS OPERATING ENERGY	0.347 GIGA JOULES
TOTAL SYSTEM OPERATING ENERGY	0.372 GIGA JOULES
TOTAL ENERGY CONSUMED	10.192 GIGA JOULES

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	1.592	0.210	N.A.	1.802 GIGA JOULES
SOLAR FRACTION	73	92	N.A.	75 PERCENT
SOLAR ENERGY USED	1.542	0.194	N.A.	1.737 GIGA JOULES
OPERATING ENERGY	N.A.	0.024	N.A.	0.372 GIGA JOULES
AUX. THERMAL ENG	0.572	0.016	N.A.	0.588 GIGA JOULES
AUX. ELECTRIC FUEL	N.A.	N.A.	N.A.	N.A. GIGA JOULES
AUX. FOSSIL FUEL	0.953	0.025	N.A.	0.978 GIGA JOULES
ELECTRICAL SAVINGS	N.A.	-0.003	N.A.	-0.350 GIGA JOULES
FOSSIL SAVINGS	2.570	0.303	N.A.	2.874 GIGA JOULES

SYSTEM PERFORMANCE FACTOR: 0.814

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: PERL-MACK ENTERPRISES
REPORT PERIOD: JUNE,1979

SOLAR/1015-79/06

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	0.786	51	0.054	N	0.009	0.000	0.069
2	1.101	60	0.049	O	0.015	0.000	0.045
3	1.111	66	0.107	T	0.015	0.000	0.096
4	1.022	70	0.054		0.014	0.000	0.053
5	1.091	73	0.060	A	0.014	0.000	0.055
6	1.058	70	0.024	P	0.013	0.000	0.023
7	0.128	50	0.078	P	0.000	0.000	0.608
8	0.256	45	0.087	L	0.000	0.000	0.339
9	0.412	48	0.082	I	0.004	0.000	0.199
10	1.126	61	0.058	C	0.017	0.000	0.052
11	1.106	69	0.078	A	0.016	0.000	0.071
12	1.093	74	0.041	B	0.014	0.000	0.037
13	1.112	77	0.062	L	0.014	0.000	0.056
14	0.902	77	0.051	E	0.010	0.000	0.056
15	0.776	70	0.046		0.007	0.000	0.059
16	0.946	67	0.043		0.011	0.000	0.045
17	0.899	65	0.078		0.011	0.000	0.087
18	1.000	66	0.059		0.010	0.000	0.059
19	0.771	59	0.047		0.005	0.000	0.061
20	1.023	68	0.038		0.013	0.000	0.037
21	1.094	71	0.017		0.022	0.042	0.016
22	0.952	70	0.049		0.011	0.000	0.051
23	0.600	64	0.077		0.004	0.000	0.129
24	1.077	71	0.058		0.015	0.000	0.054
25	0.990	73	0.049		0.011	0.000	0.050
26	0.881	76	0.032		0.008	0.001	0.036
27	0.959	73	0.036		0.013	0.000	0.037
28	1.005	74	0.035		0.013	0.000	0.035
29	1.018	77	0.041		0.011	0.000	0.041
30	*	*	*		*	*	*
SUM	27.203	-	1.646	N.A.	0.329	0.044	-
AVG	0.907	67	0.055	N.A.	0.011	0.001	0.061
NBS ID	G001	N113			G102		N111

* DENOTES UNAVAILABLE DATA.
0 DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
COLLECTOR ARRAY PERFORMANCE

SITE: PERL-MACK ENTERPRISES SOLAR/1015-79/06
REPORT PERIOD: JUNE,1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	0.786	0.505	0.243	59	0.309
2	1.101	0.897	0.393	69	0.356
3	1.111	0.909	0.395	78	0.355
4	1.022	0.807	0.348	79	0.341
5	1.091	0.816	0.351	83	0.322
6	1.058	0.798	0.324	79	0.306
7	0.128	0.000	0.000	49	0.000
8	0.256	0.000	0.000	47	0.000
9	0.412	0.079	0.064	47	0.154
10	1.126	0.969	0.459	71	0.407
11	1.106	0.912	0.409	80	0.370
12	1.093	0.842	0.378	88	0.345
13	1.112	0.844	0.374	90	0.337
14	0.902	0.566	0.250	90	0.277
15	0.776	0.284	0.150	80	0.194
16	0.946	0.705	0.313	76	0.331
17	0.899	0.714	0.302	73	0.336
18	1.000	0.622	0.268	80	0.268
19	0.771	0.249	0.157	63	0.203
20	1.023	0.792	0.339	*	0.332
21	1.094	0.916	0.362	81	0.331
22	0.952	0.700	0.295	79	0.310
23	0.600	0.219	0.092	69	0.154
24	1.077	0.864	0.381	84	0.354
25	0.990	0.670	0.295	88	0.298
26	0.881	0.494	0.238	92	0.270
27	0.959	0.713	0.299	81	0.311
28	1.005	0.748	0.327	89	0.325
29	1.018	0.691	0.298	85	0.293
30	*	*	*	*	*
SUM	27.203	18.956	8.382	-	-
AVG	0.907	0.632	0.279	76	0.308
RESID	0001		0100		N100

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
STORAGE PERFORMANCE

SITE: PERL-MACK ENTERPRISES
REPORT PERIOD: JUNE,1979

SOLAR/1015-79/06

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	0.218	0.054	0.069	121	0.561
2	0.344	0.049	0.140	134	0.549
3	0.336	0.107	-0.016	141	0.270
4	0.286	0.054	0.072	146	0.442
5	0.289	0.060	0.036	152	0.332
6	0.265	0.024	0.031	155	0.209
7	0.000	0.078	-0.228	141	1.000
8	0.000	0.087	-0.164	116	1.000
9	0.066	0.082	-0.061	100	0.326
10	0.409	0.058	0.252	118	0.760
11	0.348	0.078	0.104	139	0.522
12	0.305	0.041	0.077	150	0.387
13	0.300	0.062	0.024	156	0.287
14	0.191	0.051	-0.053	153	-0.010
15	0.102	0.046	-0.077	145	-0.307
16	0.266	0.043	0.038	143	0.304
17	0.259	0.078	0.014	146	0.354
18	0.222	0.059	0.005	149	0.288
19	0.099	0.047	-0.074	142	-0.272
20	0.283	0.038	0.097	146	0.477
21	0.287	0.073	0.024	154	0.335
22	0.245	0.049	0.004	153	0.216
23	0.078	0.077	-0.138	144	-0.780
24	0.314	0.058	0.105	145	0.518
25	0.251	0.049	0.019	152	0.270
26	0.198	0.032	-0.020	151	0.057
27	0.247	0.036	0.036	152	0.289
28	0.262	0.035	0.028	156	0.242
29	0.245	0.041	-0.019	156	0.089
30	*	*	-0.130	*	*
SUM	6.947	1.703	0.192	-	-
AVG	0.232	0.057	0.006	143	0.273
NES ID	Q200	Q201	Q202		N108

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
HOT WATER SUBSYSTEM

SITE: PERL-MACK ENTERPRISES
REPORT PERIOD: JUNE,1979

SOLAR/1015-79/06

DAY OF MON.	HOT WATER LOAD MILLION BTU	SOLAR FR.OF LOAD PER CENT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	SUP. WAT. TEMP DEG F	HOT WAT. TEMP DEG F	HOT WATER USED GAL
1	0.058	52	0.042	N	0.042	N	0.070	N	0.070	63	144	88
2	0.042	65	0.043	O	0.017	O	0.029	O	0.072	67	137	68
3	0.108	84	0.107	T	0.030	T	0.051	T	0.178	59	139	157
4	0.051	87	0.054		0.006		0.011		0.090	61	138	75
5	0.057	95	0.060	A	0.007	A	0.012	A	0.100	57	138	78
6	0.020	82	0.024	P	0.008	P	0.013	P	0.041	60	138	29
7	0.086	63	0.072	P	0.044	P	0.073	P	0.120	61	141	126
8	0.031	39	0.019	L	0.027	L	0.046	L	0.031	65	143	47
9	0.042	24	0.017	I	0.064	I	0.107	I	0.029	64	146	62
10	0.050	43	0.038	C	0.039	C	0.065	C	0.063	61	143	74
11	0.093	57	0.078	A	0.049	A	0.082	A	0.130	59	142	134
12	0.034	87	0.041	B	0.000	B	0.000	B	0.068	60	137	51
13	0.053	99	0.062	L	0.000	L	0.000	L	0.104	60	138	79
14	0.044	100	0.051	E	0.000	E	0.000	E	0.085	64	137	67
15	0.044	80	0.046		0.015		0.025		0.076	59	137	68
16	0.044	68	0.043		0.016		0.026		0.071	64	142	65
17	0.084	65	0.078		0.035		0.058		0.130	64	139	121
18	0.052	97	0.059		0.000		0.000		0.098	58	136	79
19	0.060	57	0.047		0.041		0.069		0.079	64	135	91
20	0.033	78	0.038		0.000		0.000		0.064	62	138	51
21	0.013	93	0.017		0.000		0.000		0.029	58	136	20
22	0.050	65	0.049		0.018		0.030		0.081	61	138	76
23	0.091	64	0.077		0.033		0.054		0.129	60	142	130
24	0.052	85	0.058		0.007		0.012		0.096	59	141	78
25	0.045	83	0.049		0.008		0.013		0.082	62	137	70
26	0.027	89	0.032		0.000		0.000		0.053	68	138	43
27	0.032	83	0.036		0.009		0.015		0.060	61	139	48
28	0.028	97	0.035		0.000		0.000		0.058	61	139	44
29	0.036	85	0.041		0.008		0.014		0.069	67	140	54
30	*	*	*		*		*		*	*	*	*
SUM	1.509	-	1.462	N.A.	0.542	N.A.	0.903	N.A.	2.436	-	-	2247
AVG	0.050	73	0.049	N.A.	0.018	N.A.	0.030	N.A.	0.081	62	139	75
NBS	Q302	N300	Q300	Q303	Q301	Q305	Q306	Q311	Q313	N305	N307	N308

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SPACE HEATING SUBSYSTEM

SITE: PERL-MACK ENTERPRISES
REPORT PERIOD: JUNE,1979

SOLAR/1015-79/06

DAY OF MON.	SPACE HEATING LOAD MILLION BTU	SOLAR FR.OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG TEMP DEG. F	AMB TEMP DEG. F
1	0.012	100	0.012	0.001	0.000	N	0.000	-0.000	0.019	77	51
2	0.006	100	0.006	0.001	0.000	O	0.000	-0.000	0.010	78	60
3	0.000	0	0.000	0.000	0.000	T	0.000	0.000	0.000	81	66
4	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	80	70
5	0.000	0	0.000	0.000	0.000	A	0.000	0.000	0.000	80	73
6	0.000	0	0.000	0.000	0.000	F	0.000	0.000	0.000	80	70
7	0.015	41	0.006	0.000	0.009	F	0.014	-0.000	0.010	78	50
8	0.074	92	0.068	0.006	0.006	L	0.009	-0.001	0.106	76	45
9	0.065	100	0.065	0.010	0.000	I	0.000	-0.001	0.101	77	48
10	0.021	100	0.021	0.004	0.000	C	0.000	-0.000	0.032	77	61
11	0.000	0	0.000	0.000	0.000	A	0.000	0.000	0.000	79	69
12	0.000	0	0.000	0.000	0.000	B	0.000	0.000	0.000	80	74
13	0.000	0	0.000	0.000	0.000	L	0.000	0.000	0.000	81	77
14	0.000	0	0.000	0.000	0.000	E	0.000	0.000	0.000	81	77
15	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	81	70
16	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	80	67
17	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	81	65
18	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	81	66
19	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	80	59
20	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	80	68
21	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	82	71
22	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	81	70
23	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	81	64
24	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	81	71
25	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	81	73
26	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	81	76
27	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	82	73
28	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	81	74
29	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	81	77
30	*	*	*	*	*		*	*	*	*	*
SUM	0.199	-	0.184	0.023	0.015	N.A.	0.023	-0.003	0.288	-	-
AVG	0.007	92	0.006	0.001	0.000	N.A.	0.001	-0.000	0.010	80	67
NBS	Q402	N400	Q400	Q403	Q401		Q410	Q415	Q417	N406	N113

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENVIRONMENTAL SUMMARY

SITE: PERL-MACK ENTERPRISES
REPORT PERIOD: JUNE,1979

SOLAR/1015-79/06

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	DAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	1673	N	51	59	N	N	N
2	2345	O	60	69	O	O	O
3	2365	T	66	78	T	T	T
4	2176		70	79			
5	2322	A	73	83	A	A	A
6	2252	P	70	79	P	P	P
7	274	P	50	49	P	P	P
8	545	L	45	47	L	L	L
9	878	I	48	47	I	I	I
10	2397	C	61	71	C	C	C
11	2354	A	69	80	A	A	A
12	2328	B	74	88	B	B	B
13	2366	L	77	90	L	L	L
14	1921	E	77	90	E	E	E
15	1652		70	80			
16	2014		67	76			
17	1913		65	73			
18	2128		66	80			
19	1642		59	63			
20	2178		68	*			
21	2328		71	81			
22	2026		70	79			
23	1277		64	69			
24	2293		71	84			
25	2106		73	88			
26	1876		76	92			
27	2042		73	81			
28	2139		74	89			
29	2167		77	85			
30	*		*	*			
SUM	57908	N.A.	-	-	-	-	-
AVG	1930	N.A.	67	76	N.A.	N.A.	N.A.
NBS ID	G001		N113			N115	N114

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